Analysis of Satellite-Based TC Intensity Estimation in the WNP

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Objectives and Motivation

Satellite-based recon is the workhorse for TC monitoring in the WNP, yet the intensity estimation methods have not been carefully validated since a/c recon left the WNP 23 years ago

Newly-developed automated methods have become operationally available and show promise, but have only been validated in the Atlantic

The TCS-08/TPARC campaigns in 2008 offered a rare opportunity for in situ observations of WNP TC core intensities, and validation of satellite-based

Assets brought to the WNP for the TCS-08/TPARC field campaigns

USAF C-130 from the 53rd WRS, with Dropsondes and SFMR

NRL P-3, with Dropsondes and Eldora radar

Drifting buoys deployed by the C-130

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Satellite-based Methods to be Validated

Dvorak Technique **-- IR/VIS, Primary operational tool, Manual**

Advanced Dvorak Technique (ADT) **– Objective/Automated**

Advanced Microwave Sounding Unit (AMSU) **– Obj/Auto, Method based on polar-orbiter 54GHz microwave data**

Validation Experiment Set-up

Automated ADT, AMSU and SATCON all run and documented at CIMSS in real time (CIRA-based AMSU estimates also made available to CIMSS in real time)

Real time operational Dvorak estimates collected from JTWC, NESDIS-SAB, and JMA

Independently-derived Dvorak estimates by 5 experienced satellite analysts 'blind' to the real time recon data and operational Dvorak estimates were made available to CIMSS following the field experiment

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Validation Experiment Setup - Additional Notes

ADT run in two modes: With and w/o microwave input

AMSU estimates from two methods: CIMSS and CIRA (CIRA occasionally unavailable due to method constraints)

SATCON reflects availability of 2 or 3 consensus members

Dvorak results from JMA include 10min. > 1min. conversion to Vmax, and Koba et al. Tnum > Vmax

.... cue the crickets

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Validation Cases during TCS-08/TPARC

TC Nuri (13W)

TC Sinlaku (15W)

TC Jangmi (19W)

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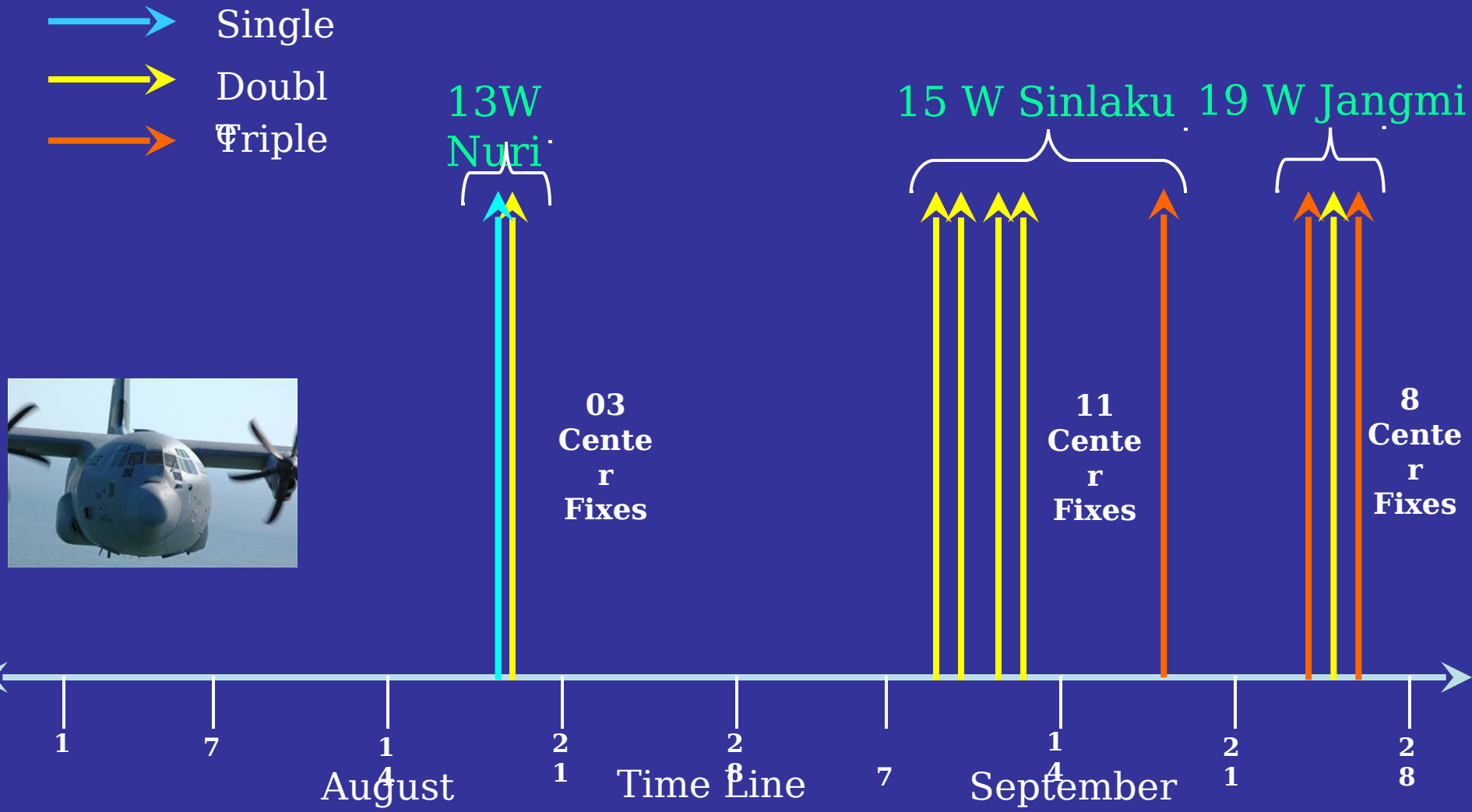
WC-130J Penetrations



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WC-130J storm center fixes within +/- ~4 hours of corresponding AMSU overpasses

Storm	yyyymmddhhmm	lat	lon	mslp	msw	amsu_pass(ddhhmm)
13W	200808172300	15.77N	133.62E	994	45	172008
13W	200808182200	16.95N	127.25E	977	78	182034
15W	200809090600	17.87N	125.25E	986	62	090511
15W	200809100600	20.24N	124.33E	954	90	100501
15W	200809100800	20.42N	124.37E	946	100	100807
15W	200809111300	21.80N	124.75E	940	90	110819
15W	200809121700	23.83N	123.22E	953	90	121713
15W	200809180400	30.33N	130.24E	981	65	180818
15W	200809190400	33.02N	135.09E	975	75	190755
15W	200809191800	34.18N	139.22E	978	65	192014
19W	200809242100	13.50N	134.18E	991	55	242001
19W	200809260000	15.77N	129.65E	973	75	251640
19W	200809260200	16.10N	129.35E	967	80	260506
19W	200809270900	21.09N	124.78E	904	135	270832

TCS-08 satellite validation cases were limited!

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The final values for Max Sustained Wind (MSW or Vmax) used for validation of the satellite-based estimates were derived from multiple recon sources for each eye penetration by a selected team of analysts headed by Prof. R. Elsberry (NPS)

Preliminary Findings

None of the results are statistically significant due to the very limited number of validation cases

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Comparison of Dvorak-Based Estimates – Vmax (Kts)

N=15	'Blind' Dvorak Consensus	Oper Dvorak Consensus	Oper Dvorak Consensus (w/JMA Koba adj)	ADT	ADT w/MW
Bias	5.0	4.1	3.6	0.0	-1.1
Abs Error	10.9	15.0	13.0	16.1	14.1
RMSE	14.0	18.0	15.2	19.4	17.6

Positive Bias indicates method estimates are too strong

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Comparison of "Blind" Dvorak Analyst Estimates – Vmax (Kts)

N=15	Analyst 1	Analyst 2	Analyst 3	Analyst 4	Analyst 5
Bias	1.7	8.1	9.9	2.0	1.2
Abs Error	7.9	11.9	16.9	12.7	12.6
RMSE	9.6	15.8	19.9	15.7	15.0

Positive Bias indicates method estimates are too strong

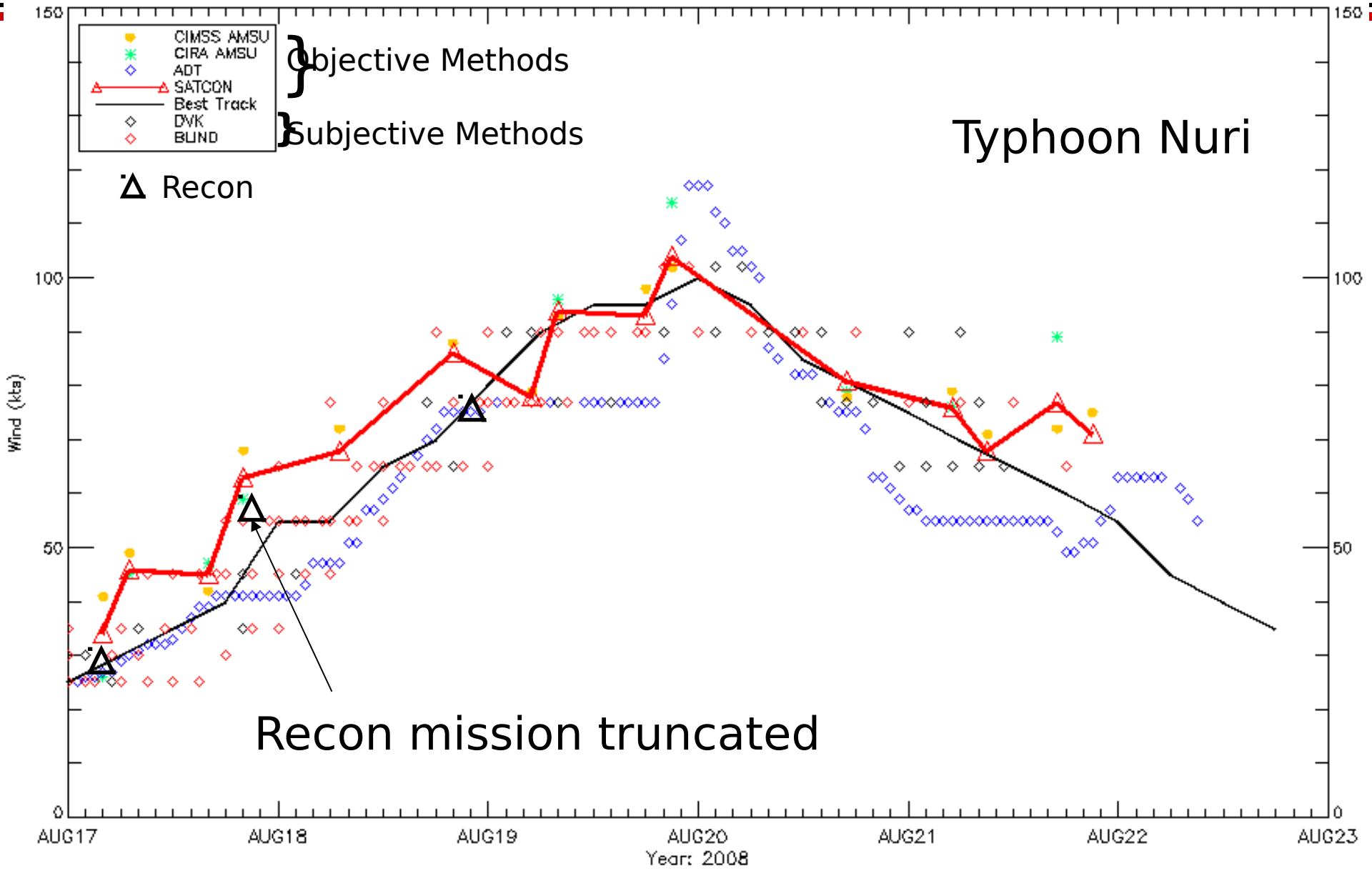
Analysis of Sat-Based TC Intensity Estimation in the WNP

Comparison of All Satellite-based Estimates – Vmax (Kts)

N=13	'Blind' Dvorak Consensus	Oper Dvorak Consensus (w/Koba)	ADT w/MW	CIMSS AMSU	SATCON
Bias	2.9	1.4	-5.8	3.1	0.2
Abs Error	9.1	12.3	12.8	9.2	9.1
RMSE	11.8	14.8	16.6	10.7	11.1

Positive Bias indicates method estimates are too strong

Typhoon Nuri (13W) Intensity Estimates Versus Recon



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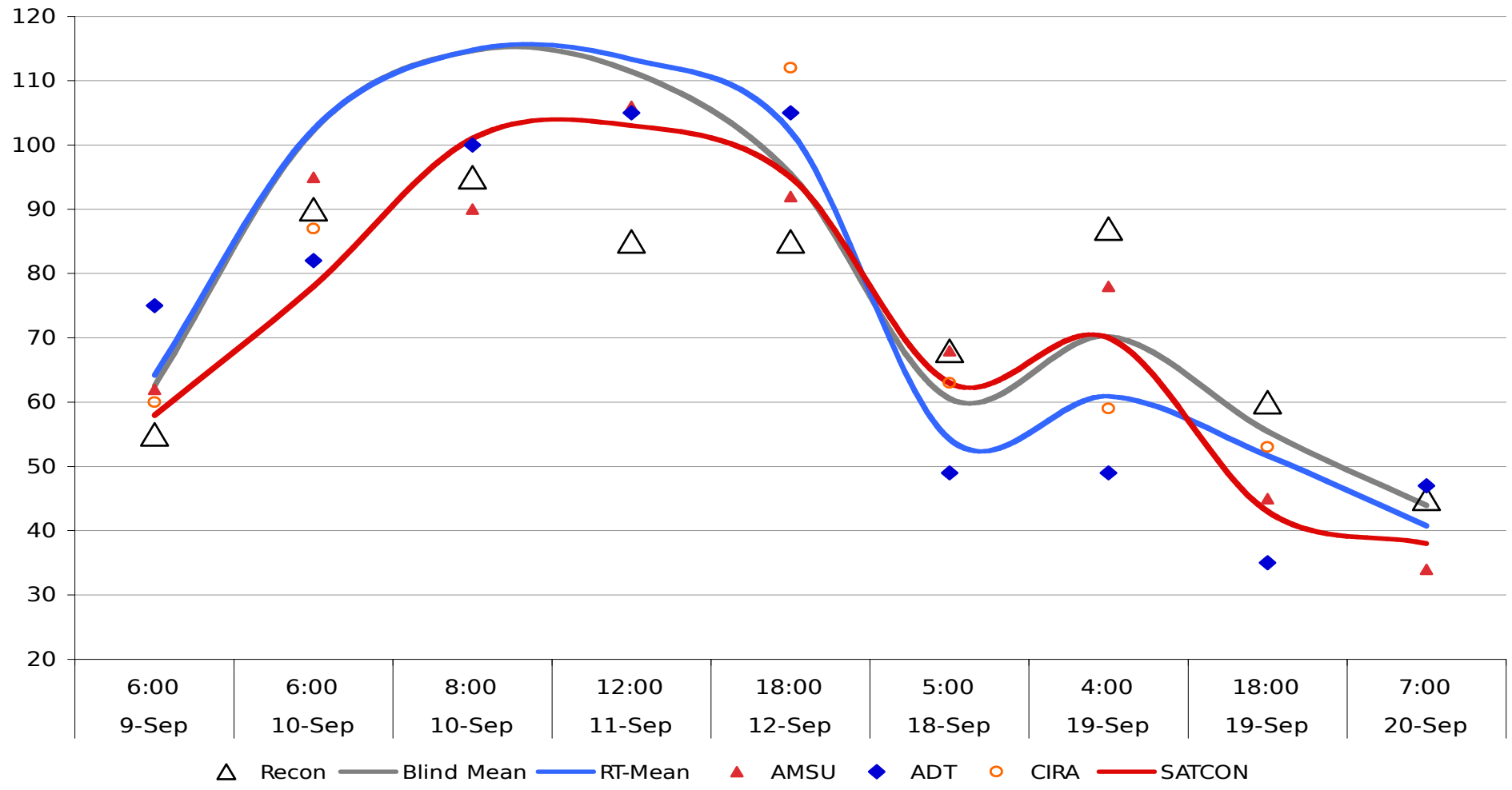

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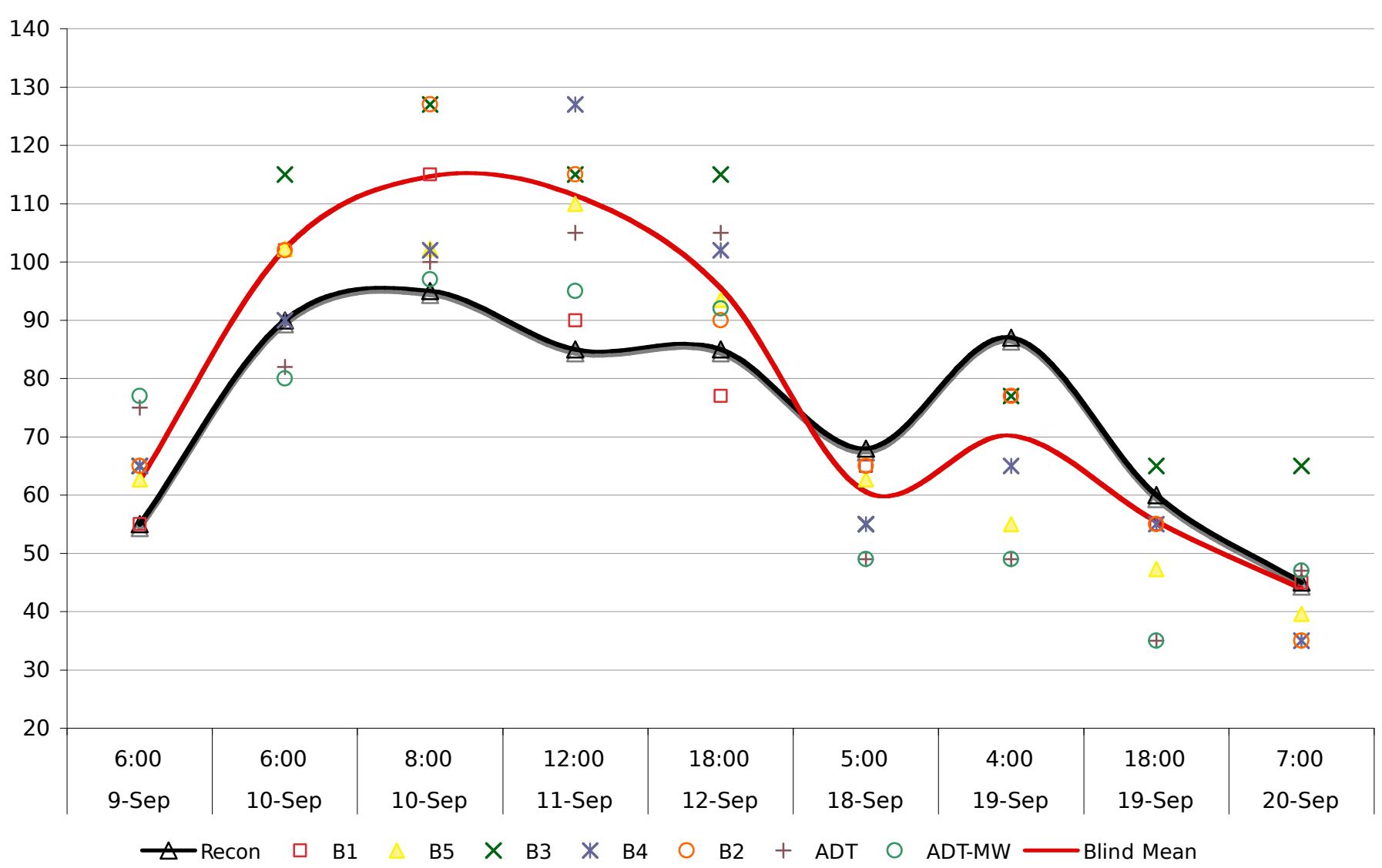

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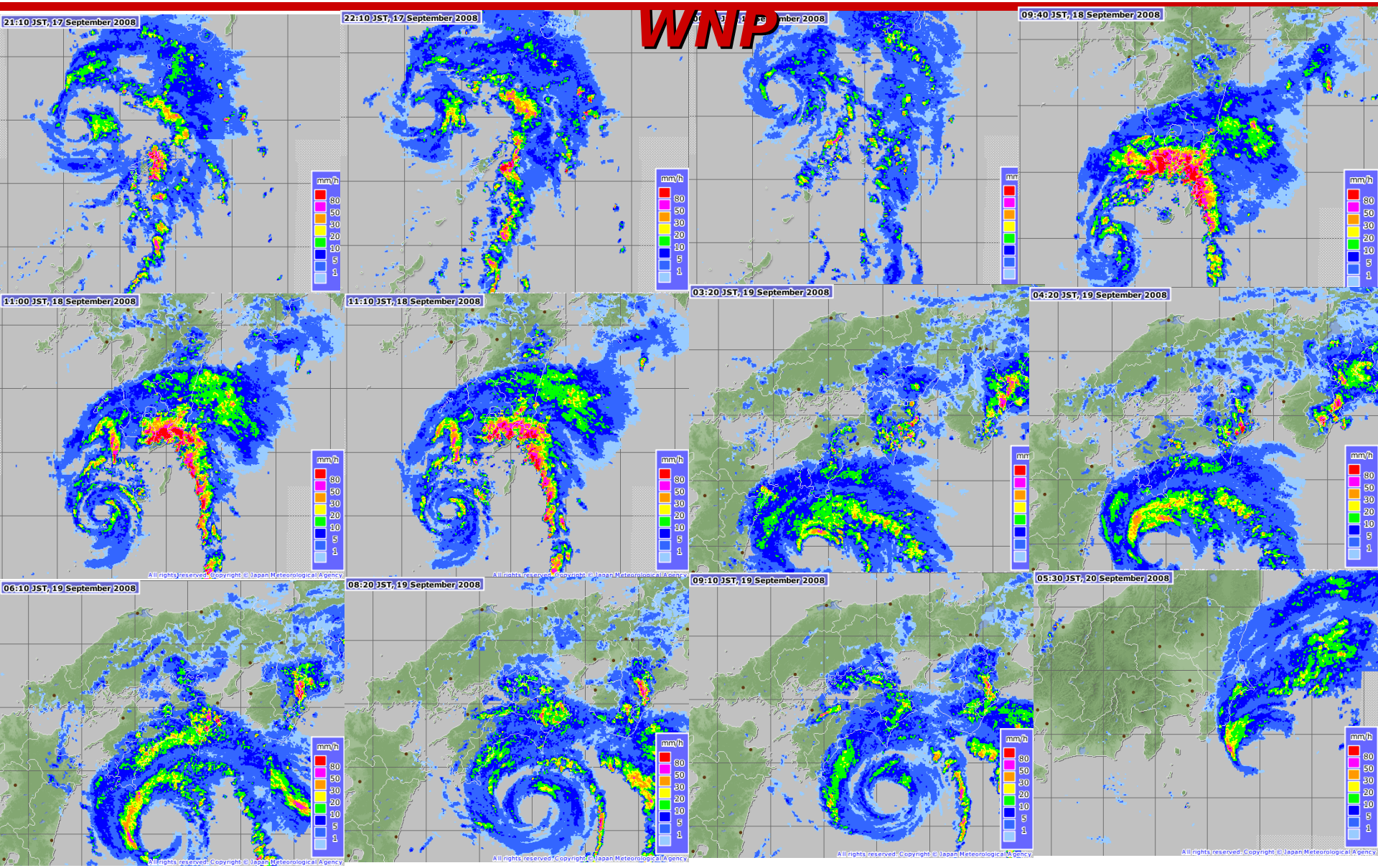

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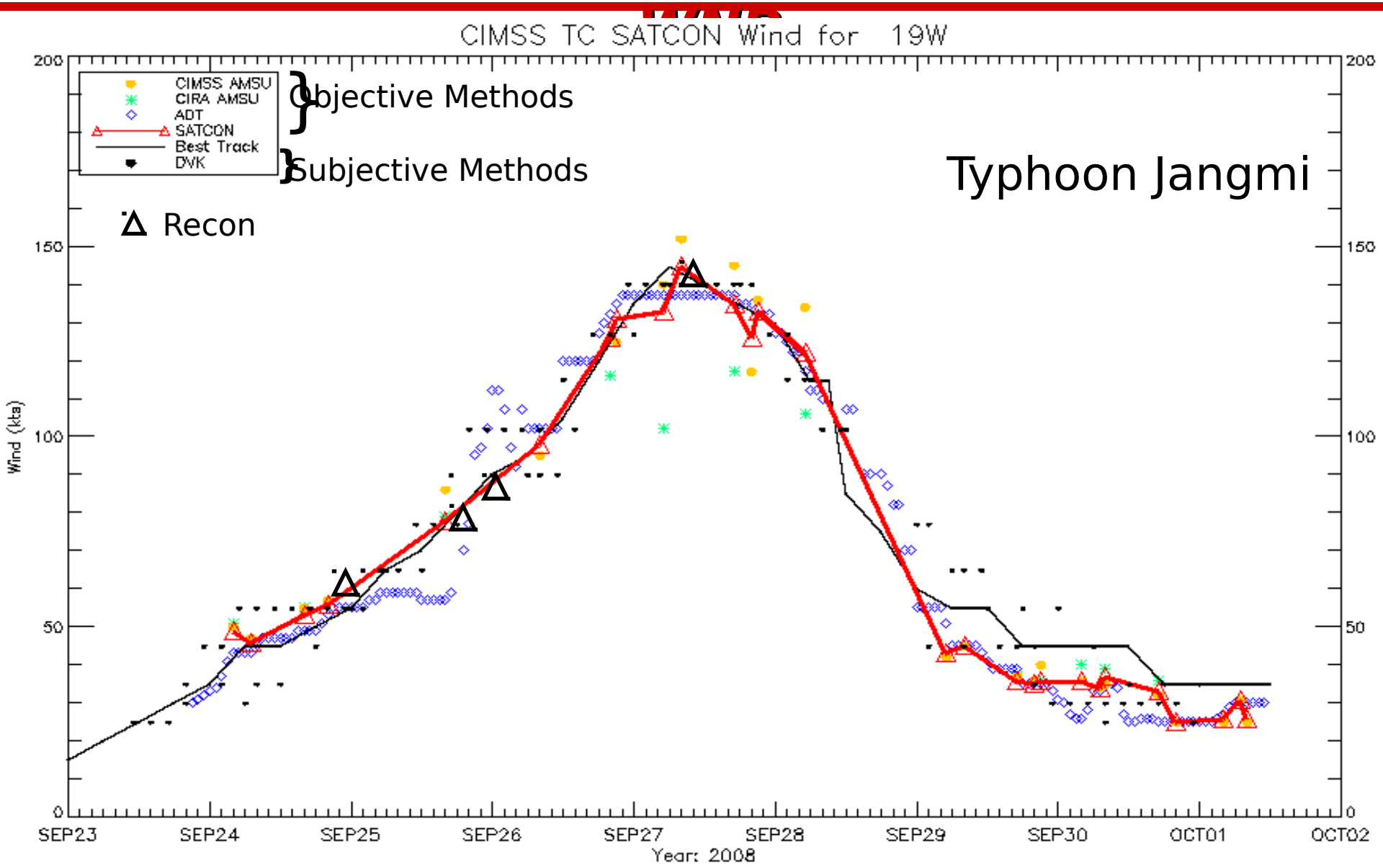

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Summary of Preliminary Findings

(Based on limited sample of 15 recon validation points)

- **Ave. Vmax estimate errors (kts): Dvorak: ~11 (blind), ~13 (oper), ~14 (ADT)**
- **Subj Dvorak ave error spread (kts): 8-17 ('blind' analysts), 11-15 (oper agencies)**
  [JMA (incl their Koba et al. Tnum>Vmax adjustment) superior to other 2 agencies]
- **AMSU (CIMSS) and SATCON ave errors (kts): Both ~ 9 (subset of 13 val. pts)**

General Preliminary Conclusions

- **Objective satellite- based methods are very competitive with Dvorak**

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"Mai Tai's taste a lot better than Miller Lites …wish I was there!!"

Chris Velden
(from his post-op recovery pad in Madison)